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STEAM FLYING MACHINE

THE SPEED AND POSSIBILITIES OF THE LANGLEY APPARATUS.

A Talk with the Inventor About Principles of Successful Flight and How He Discovered Them.

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WASHINGTON, Dec. 12.—Within the past few months an invention has been made here at Washington which promises to revolutionize the travel of the world. It may transfer the vessels of the ocean to the air and carry the locomotives among the clouds. The development of it will, in all probability, change the warfare of the world, and it may make war so terrible that the national troubles of the future will be settled by arbitration. I refer to Mr. Langley's aerodrome. The word means air-runner, and the machine is such that it runs faster upon the surface of the air than a horse can trot.

For sixteen years Mr. Langley has steadily pursued his work upon it. Engrossed as he has been, first in astronomical investigation and later in administering the greatest of our scientific institutions, he has had only his leisure moments to devote to it, and now, after thousands of experiments and hundreds upon hundreds of failures, he has accomplished what scientists once declared to be impossible. Knowing that his work was done almost at the risk of his scientific reputation being questioned, during the early years of it he kept the object of his investigations to himself. To-day the world knows practically nothing of them, and it was only last May, after persistent urging on the part of his friend, Prof. Alexander Graham Bell, that he allowed him to state the fact that he had succeeded.

THE AERODROME IN FLIGHT.

Since then additional improvements have been made. A new and better machine than that which flew a half a mile in May last has been tested. It has made a more successful flight, and to-day Mr. Langley permits me to give in my own words the first full description of his success to the public. I have spent several days with him upon the island in the Potomac river, about thirty miles below Washington, where his last experiments have been conducted, and on Saturday, Nov. 28, I witnessed the most successful flight which has yet been made. I saw this machine, made chiefly of steel, weighing as much as a four-year-old boy, yet so large that it would just about fill the average parlor, moved by a steam engine which was a part of it, dart forth from the launching stage and fly in an almost straight line through the air a distance of more than 1,500 yards, or over three-quarters of a mile. It flew almost as far as the length of Pennsylvania avenue between the treasury and the Capitol. The flight was horizontal. There was not a quiver of the wings, and the great bird-like aerodrome swam as it were, upon the planes of the atmosphere. It first flew to the right, across the bay toward a strip of woods, and, as Mr. Langley and myself watched it, our hearts for the moment came into our throats, for it seemed as though it would dash itself against the trees. As it neared them, however, it gracefully swept round and downward, then turned and rose and as straight as an arrow flew across the bay where we were standing on toward Washington. It continued to fly in this straight horizontal line until the water which furnished the steam was exhausted, when it slowly but gracefully swept down and rested upon the water. It lighted so gently that not a bit of its machinery was injured, and had it not been that the evening shades were falling it could have been flown again. I have never seen any inanimate thing look so like a thing of life.

It was as graceful as any bird, and as it swam through the air its propellers, which were going about at the rate of over a thousand revolutions a minute, made a whirring noise like the wings of a bird in rapid flight. The feathery smoke of the engine could be seen wreathing its way out of the smoke stack, and, as the setting sun caught its silken wings, and the white silvery substance which bound the body containing its machinery, it seemed like a wonderful new species of bird. The great danger of losing the machine in the trees led Mr. Langley to put only enough water in it to allow it to fly about one and one-half minutes. It could have carried water for about five minutes, but, as it was, it flew by two independent stop-watches one minuate and forty-five seconds, being the only flight of any aerial machine except itself which has every lasted for more than a very few seconds. In this minute and three-quarters it flew a distance of almost a mile, going at the rate of over thirty miles an hour, and showing that if it had been fully supplied with water it would have flown for more than two miles. As it was, its flight was only limited by the exhaustion of its steam, and there seemed no reason but that with more steam to run it, it might have gone on indefinitly. With a machine ten times its weight, Mr. Langley told me, a condensing apparatus could be carried upon it which could use the water over and over again, and the same amount of water would carry it for hundreds of times its present flight. The machine flew against the wind. There was nothing of the balloon nature about it. There were no gas bags to uphold it. Its wings were immovable, and they merely steadied it as it flew like a bird through the air. The force which carried it onward was generated upon it.

WONDERS OF THE AERODROME.

As I looked at it I could hardly realize the remarkable thing which Mr. Langley has accomplished. Let me repeat it.

The aerodrome is a machine made almost altogether of steel. A balloon floats because it is lighter than the air. This machine weighs more than one thousand times as much as the air through which it moves. The working parts of its machinery are of steel, and it carries a peculiar steam engine which forces it along through the air. In constructing this machine the question of weight was an all important one and everything had to be reduced to the minimum. The aerodrome, weighing less than thirty pounds, carries about four pounds of water. This is about two quarts, and the little engine is so wasteful of it that its flight must be proportionately short, for when the water has been once converted into steam the aerodrome must stop flying, as there is no more water to furnish steam to run it. The machinery of the air runner is very light, indeed, but it requires a considerable force to move it in proportion to its weight. Its engine is equal to more than one horse power, and the movable parts of the machinery weigh twenty-six ounces. You could put all of its machinery into a peck measure. Now, a horse weighs a thousand pounds. Think of reducing the size of a horse to a peck measure and its weight to that of a kitten and you have some idea of Mr. Langley's aerial engine.

What does the aerodrome look like?

I have described it in flight. I examined it at rest and I have gone carefully over its different parts. It is about fifteen feet long and about fourteen feet wide from the tip of one wing to the other. The machine moves through the air on much the same principle as that by which the twin-screw steamer forces its way through the water. On each side of the aerodrome there is a sort of screw propeller or pair of blades in the shape of one cutting of a screw hung upon a pivot that when the steam is on they fly around at the rate of a thousand revolutions a minute. They look, in fact, much like the wheels of an electric fan when in action. They cut the air so rapidly that you cannot see the blades, and they are, in fact, a pair of wheels about four feet in diameter flying at this wonderful speed around through the air. As they move they screw the air ship onward, and this advancing motion keeps it up in somewhat the same way that a swift skater can be supported by thin ice.

The machinery is in a metal receptacle which ends in a smokestack. This is hung to a frame work of steel. The wings, which are stationary, are fastened to the upper part of the frame work, and they extend out, above the body holding the machinery. The machinery is wonderfully delicate, but it is as strong and at the same time as light as scientific investigation can make it. The fuel is gasoline, which is converted into gas before it is used, and which furnishes such an intense heat that it would melt the boiler in a second if there were not a special pump by which the water is kept flowing rapidly through the boiler, the intense heat converting some of the water into steam as it flows. Every part of the machinery is of the most practical nature and it has been constructed at an enormous expense of patience and experiment. It may be said that nearly every atom of the aerodrome as it is now put together is the result of experiment. The making of the boiler alone consumed months of work. Every bit of the machinery had to be constructed with scientific accuracy. It had to be tested again and again. The difficulty of getting the machine light enough was such that every part of it had to be remade many times. It would be in full working order when something would give way, and this part would have to be strengthened. This caused additional weight and necessitated the cutting off of that much weight from some other part of the machinery. At times the difficulty seemed almost heartbreaking, but Mr. Langley went on piece by piece and atom by atom, until he at last succeeded in getting all the parts of the right strength and proportions. Even after he had completed his model and had it ready for flight, he was confronted with an unexpected difficulty, which was, it seemed at the time, almost impossible to surmount.

LAUNCHING THE AIR-RUNNER.

This was the launching of the machine into the air. One of the most difficult things that large, soaring birds have to contend with in flying is in getting a start. You know how difficult it is to launch a ship into the water. It is far more difficult to launch an air ship. Mr. Langley found that his machine had to be clamped down on the launching stage and to be arranged in such a way that the machinery could be started, so that it should receive a slight initial velocity and then be released with a spring. This looks easy. It was hard. But Mr. Langley at last succeeded in launching his machine by hanging it to a movable table, so that it could be turned to face the direction in which the flight was to be made, and so that the wheels of the the table would carry the aerodrome straight out in a horizontal line and launch it off into the air. The launching apparatus which we used on Nov. 28 was built on the top of a house boat, and the work of arranging the table was no small one. As I stood upon it and examined its construction Mr. Langley said:

"It don't seem to be much, but it is the result of five years of experiments."

I here asked Mr. Langley what first attracted his attention to aerial navigation.

"I can't tell when I was not interested in it," he replied. "I used to watch the birds flying when I was a boy and to wonder what kept them up. I afterward heard the theory that they possessed great muscular power. You know some scientific men have stated their belief that the muscular strength of birds must be enormously greater in proportion than that of men. But this it seemed to me could not be true. I could not believe what some French mathematicians calculated, namely, that an eagle must be nearly as strong as man. It finally occurred to me that there must be something in the condition of the air which the soaring birds instinctively understood, but which we do not. This idea I held for a long time, the flight of birds continuing to be a wonder to me. It is curious how an idea of that kind sticks to you. I seldom saw a bird flying that I did not think of it, and even lately I have watched them for hours, trying to understand how they could move about through the air, rising and falling, soaring up and sailing down without any motion of the wings."

"But, Mr. Lanley, I thought that birds used a great deal of strength to fly. They can't fly without moving their wings, can they?"

"The soaring birds can," replied Mr. Langley, "and they do fly long distances with apparently very little exertion. Darwin once watched the South American condors, which, you know, are immense birds, for hours. He says they ascended and descended, soared and circled about, with scarcely the movement of a feather. He could not detect a single flap of their wings.

"I remember," continued Mr. Langley, "how I stood one cold November day on the aqueduct bridge that crosses the Potomac river above Georgetown and whtched a turkey buzzard which was lazily soaring round and round watching something in the river below. The wind was blowing a gale. It was going at the rate of at least thirty-five miles an hour, still the bird moved about with the greatest ease, keeping generally on a level, but swaying a little as it went round and round. It was not more than sixty feet above me. I could see it perfectly and could not note the flapping of a wing, though I watched it for a long time. I stayed, in fact, until I got so cold that I had to leave."

LANGLEY'S FIRST EXPERIMENT.

"Then you early saw that there was something wrong in our theories as to the wind, Mr. Langley?"

"Yes," was the reply. "I have always felt so, and I remember well when I began to experiment to see if my supposition was correct. It was after a meeting of a scientific association, in which some one stated that an inanimate thing could, under certain circumstances, be made to move in the air against the wind by the power of the opposing wind itself. He claimed that he had made experiments proving this fact, and he stated as an evidence of the truth of his theory that he had seen birds not only come close to the earth and hang stationary in the air, but even advance against the wind and ascend in the air without flapping their wings. He was laughed at, but it is now conceded that what he claimed is not theoretically impossible. I, myself, did not believe he was right at the time, but it set me thinking. My old interest in the subject revived and I began at once to make experiments. I wanted to know the actual facts as to the power needed for flight, and how it was possible that bodies heavier than the air they displaced could keep themselves in the air without falling. I did discover that there was no doubt but that a machine could be made which could support bodies in the air, and which would carry them forward. I have shown you here to-day a machine which will do this. I have proved that we have the power, and the only question is to learn how to direct and control it."

"Tell me something of your experiments, Mr. Langley," said I.

"My first experiments were made when I was connected with the astronomical observatory in Pittsburg. It is now more than fifteen years ago that I built my first laboratory for aerial investigation there. A friend of mine, Mr. William Thaw, a wealthy citizen of Pittsburg, supplied the means, and I was enabled to make all sorts of tests to ascertain the power used in aerial motion. One device which I had was a whirling table. This was an arm about thirty feet long, which swung about on a central pivot, ten feet above the ground. It was moved by a ten-horse power steam engine, and it went flying around, moving at all speeds up to seventy miles an hour. Now, on the end of the arm I put instruments which would measure the lifting power of the wind upon any inclined surface hung to them. I had, for instance, a spring scale hung there, and to this brass plates were attached. When the arm was put in motion I found that the faster it went the less weight the plates registered on the scales, until at great speed they almost floated in the air. I found, in fact, that the higher the speed the less was the force required to keep the plates from falling. This seems at first a contradiction of known principles, but I have no time now to explain it. I found that not one-twentieth of the force before supposed to be required to support bodies under such conditions was needed, and what before had seemed impossible began to look possible.

EASE OF FLIGHT.

"This means that I found," continued Mr. Langley, "that an entirely wrong estimate had been made as to the force needed to sustain moving bodies in the air. Some mathematicians, reasoning from false data, had concluded that if it took a certain amount of power to keep a thing from falling, it would take much additional power to make it advance. My experiments showed just the reverse. I found that it took much less force to push a body rapidly through the air than was needed to simply sustain it there. I found, in short, that the conditions of air travel with my planes and of land and sea travel were in one important respect the opposites of one another. An ocean steamer running at twenty knots an hour will take several times as much coal as is required to run it at the rate of ten knots an hour. The limited express uses a great deal more coal than the slow freight for the same weight and distance. This is not so in aerial flight with planes. Actual experiment shows, I repeat, that the faster the speed the less the force required to sustain the planes and that it would cost less to transport such planes through the air at a high rate of speed than at a low one. I found further that one horse power could carry brass plates weighing two hundred pounds at the rate of more than forty miles an hour in horizontal flight. Everything, however, depended upon the flight being strictly horizontal. I found that if it were the least irregular the power must be increased in proportion to the irregularity."

"It must have been interesting, Mr. Langley," said I.

"It was interesting," replied Mr. Langley, "but so far it had been conducive to no practical results. I had been working now for years seeking to learn the principles involved in flight. I thought I discovered some of them. The question was how to apply them. The field, you know, was entirely new. I had to make and to a large extent invent the machinery I used. My experiments showed me that I must have a very light engine; but they did not tell me how to get it. They did not show me how to keep the flight horizontal, nor did they give me any idea how such a machine as I might construct could be made to start and light in safety. There were a number of other things which I should have liked to know, and some of which I still hope to learn, which were entirely in the dark. As the result of my work I had some extremely important and valuable facts, but my experiments so far had not told me how to apply those facts to the making of machines for flying. I had only the conviction that what had hitherto been an impossible fancy might in the future become a mechanical fact. I could see, at any rate, from what I had learned that the subject was worth a new and scientific investigation."

RUBBER MOTORS.

"How did you go about the work of applying your facts?" said I.

"I next began a very different kind of experiments," replied Mr. Langley. "The average man might have looked upon my next work as somewhat childish. I spent many hours in experimenting upon little toys, which I tried to make actually fly. I had my facts, you know, and I wanted to see how they would work out in actual practice. The only thing that had yet been done in making the toys or anything that would fly was by an ingenious Frenchman, named Penaud, who a decade or more ago had made a flying toy by twisting strands of rubber, which in untwisting turned a little propeller wheel made of a couple of feathers. The propellers moved the toy forward. They kept it in the air for a number of seconds, enabling it to fly from fifty to one hundred feet. Simple as this toy looked, it was the father of a future flying machine, and France ought to have the credit of it. I tried the same thing again and again on a larger scale, my object being to learn what the conditions were by which we could secure a horizontal flight in free air."

"What did you find?"

"I did not find out a great deal. The rubber models flew so irregularly and for so short a time that I could not learn much from them. I soon saw that I must have a better motive power, I must have something that would make a machine fly long enough for me to observe how it flew. In other words, in order to learn how to make a flying machine, I must have a flying machine to begin with.

"I examined and experimented on every kind of a motor," Mr. Langley went on. "I tried compressed air, carbonic acid gas, the storage battery, the primary battery and many other things, including the gas engine. The last was the most promising, and it may some day prove to be the best; but like everything else I found it too heavy, for you see the engine had to be exceedingly light in proportion to the power. After much experiment of this kind I concluded that the only immediate hope was in the steam engine, and that it could only be used provided it could be built to a degree of lightness which had hitherto never been attained. I had to have nearly one horse power to give me a good chance for any practical experiment. Now, it is only a few years since an engine developing this amount of power weighed as much as a horse himself. In other words, it weighed something like one thousand pounds. I had to have a one-horse power engine and boiler which together would weigh less than ten pounds, or one-hundredth the weight of a horse, and I at once went to work to make it. It took me a year to construct it, and I had the best of mechanics to help me. I reduced the weight atom by atom, building and rebuilding, until now I have what I